

REVIEW OF WESTERN ATLANTIC ELYSIIDAE (OPISTHOBRANCHIA ASCOGLOSSA) WITH A DESCRIPTION OF A NEW *ELYSIA* SPECIES

Eveline d. B.-R. Marcus

ABSTRACT

A key and morphological and comparative notes on the species of Elysiidae found in the western Atlantic warm waters with some remarks on species from other regions are given. *Elysia halimeda* Baba, 1957, and Burn, 1972, not identical with *Elysia halimeda* Macnae, 1954, is given the name *Elysia macnaei* new species. *Elysia patina* from Miami is described as a new species.

This paper provides a key for the classification of the Elysiidae. During my research I found that the details of the anatomy of the different species of *Elysia* still afford many theses on the level of Lilian Russell's (1929); I call attention to these features.

The following is a list of the western Atlantic species of *Elysia* in the same order as given in the species accounts: *Elysia ornata* (Swainson, 1840); *E. chlorotica* (Gould, 1870); *E. catulus* (Gould, 1870); *E. subornata* (Verrill, 1901); *E. flava* (Verrill, 1901); *E. picta* (Verrill, 1901); *E. papillosa* (Verrill, 1901); *E. canguza* (Marcus, 1955); *E. serca* (Marcus, 1955); *E. chitwa* (Marcus, 1955); *E. cauze* (Marcus, 1957); *E. evelinae* (Marcus, 1957); *E. tuca* (Marcus, 1967); *E. clena* (Marcus, 1970); *E. patina* new species; and *E. dui* (Marcus, 1967), a synonym of *E. picta*.

Other species of *Elysia* treated herein include: *E. viridis* (Montagu, 1804); *E. timida* (Risso, 1818); *E. minuta* (Sars, 1835); *E. fusca* (Philippi, 1844); *E. halimeda* (Macnae, 1954); *E. margaritae* (Fez, 1962); *E. slimora* (Marcus, 1966); *E. translucens* (Pruvot-Fol, 1957); and *E. fezi* (Vilella, 1968).

Information about the following western Atlantic species of other genera of Elysiidae is given: *Tridachia crispata* (Moerch, 1863); *Bosellia mimetica* (Trinchese, 1891); *B. marcus* (d. B.-R. Marcus, 1972); and *B. corinnae* (d. B.-R. Marcus, 1973).

KEY TO THE WESTERN ATLANTIC SPECIES OF ELYSIIDAE

My key contains the species I have seen. Those described from Bermuda by Verrill (1901) are not all sufficiently characterized, therefore later studies possibly will prove some of our species to be synonyms of Verrill's.

- 1a. No parapodia *Bosellia* 17
- 1b. Parapodia developed 2
- 2a. Parapodial margins frilled *Tridachia crispata* (Moerch, 1863)
- 2b. Parapodial margins may be folded but not frilled *Elysia* 3
- 3a. Parapodial edges with red, black, and blue bands *E. picta* (Figs. 13, 33)
- 3b. Parapodial edges other colors 4
- 4a. Dark spot around anal opening; teeth blunt *E. evelinae* (Fig. 29)
- 4b. Teeth pointed 5
- 5a. No dorsal vessels visible *E. chitwa* (Fig. 11)
- 5b. Dorsal vessels visible 6

6a. Renopericardiac prominence $\frac{3}{4}$ of body length	<i>E. cauze</i> (Fig. 15)
6b. Prominence shorter, at most $\frac{1}{2}$ of body length	7
7a. All lateral vessels enter prominence	8
7b. Some or all lateral vessels enter main trunks	9
8a. Renopericardiac prominence cylindrical, half body length	<i>E. patina</i> (Fig. 41)
8b. Renopericardiac prominence oval	<i>E. clena</i> (Fig. 18)
9a. All lateral vessels enter main trunks	10
9b. Part of lateral vessels enter prominence	14
10a. Main trunks collect branches only behind prominence	11
10b. Main trunks from the front and from behind unite	12
11a. Lateral vessels ramified	<i>E. marginata</i> (Fig. 4)
11b. Lateral vessels simple	<i>E. papillosa</i> (Fig. 9)
12a. Pharynx with muscular ingluvies	<i>E. picta</i> (Fig. 33)
12b. Esophagus with muscular pouch	13
13a. Main trunks unite in middle of parapodia	<i>E. tuca</i> (Fig. 17)
13b. Main trunks unite at entering prominence	<i>E. chlorotica</i> (Fig. 6)
14a. At most one anterior vessel	<i>E. canguzua</i> (Fig. 10)
14b. More than one anterior vessel	15
15a. One unpaired median vessel from behind, teeth smooth	<i>E. catulus</i> (Fig. 7)
15b. A pair of main trunks	16
16a. Main trunks straight, parallel	<i>E. serca</i> (Fig. 12)
16b. Main trunks diverging, undulating	<i>E. ornata</i> (Fig. 1)
17a. Eyes round	<i>B. mimetica</i>
17b. Eyes stalked	18
18a. Vaginal pore near end of back	<i>B. marcusii</i>
18b. Vaginal pore in front, on right side	<i>B. corinneae</i>

NOMENCLATURAL REMARKS

There is still no complete agreement as to the name to be used for the opisthobranch order Ascoglossa, Sacoglossa, or Saccoglossa. The second was published by Hermann von Ihering in 1876 (Jahrbuch Deutsche Malakologische Gesellschaft, 3 (2). In an addendum (p. 148 of the journal, 52 of the separate copy) he mentioned that Bergh was also preparing a paper on the group, giving it the name Ascoglossa.

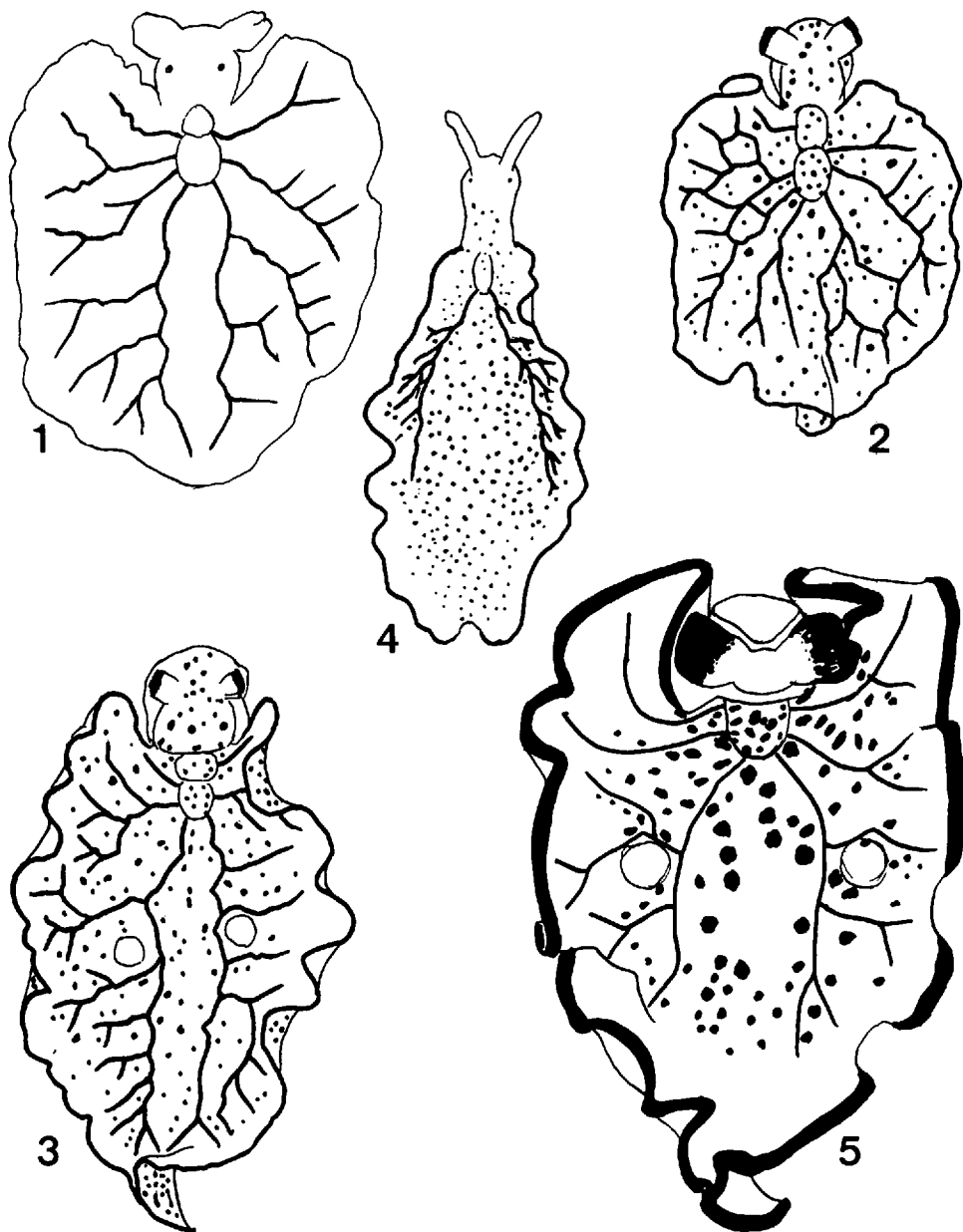
The International Code of Zoological Nomenclature, Appendix A, Code of Ethics, need not be applied in this case, as Ihering had only learned about Bergh's study when his paper was already in press. The Zoological Record for 1876 gives both names, Sacoglossa von Ihering and Ascoglossa Bergh, MS. This was published in 1878 (Verhandlungen der k.k. zoologisch-botanischen Gesellschaft Wien für 1877, 27: 807).

However, Appendix D II of the Code recommends not to use a compound name, the components of which are one Greek and the other Latin. This is the case in Saco-Glossa, while Ascoglossa is pure Greek. Hence this is the name we should all apply.

The recent review of the "Sacoglossa" in Grassé's treatise by Franc (1968: 848) is unfortunately incomplete and even faulty. The smooth *Bosellia* is figured correctly (p. 846, fig. 418), but is listed among the Polybranchidae, whose diagnosis begins: "Papilles dorsales grandes!" *Tridachia* is not mentioned at all.

The introduction of new names by later authors, who had only seen the incomplete descriptions of the older species, e.g., Thiele's (1931: 415) *Elysia* (*Elysiella*) *verrilli*, for *Placobranchus catulus* Gould, 1870, as used by Verrill 1872, is not necessary. Pruvot-Fol (1946: 40) restricted the subgenus *Elysiella* Verrill, 1872, to the Pacific *E. pusilla* Bergh.

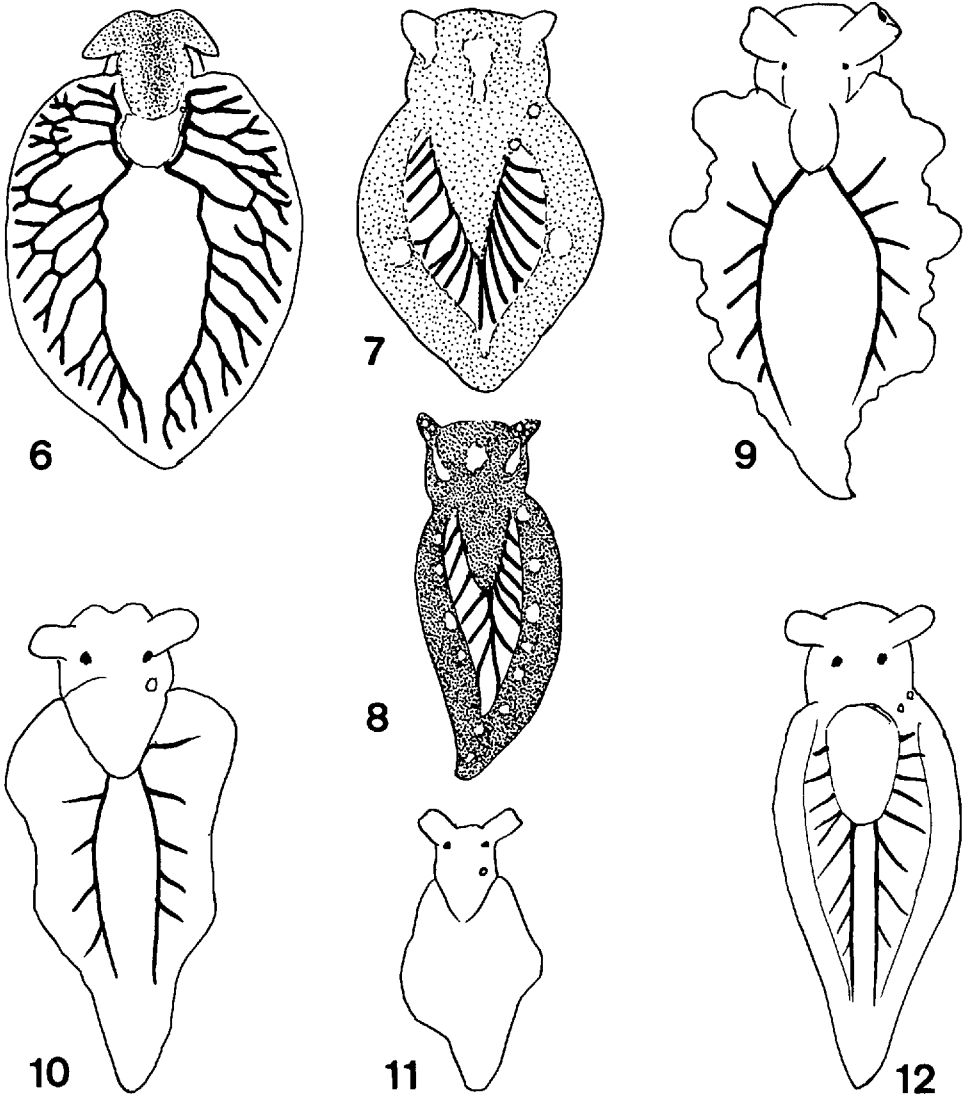
As I have seen 17 of the 20 western Atlantic Elysiidae, I feel competent to revise the family. Each of these species was discussed when we described it, so that now I only give the bibliographic references, if I have no new localities or



Figures 1-5. Dorsal vessels of *Elysia*. 1, *E. ornata*, 5 mm long. 2, same, 9 mm long. 3, same, 16 mm long. 4, *E. marginata* (from Thompson, 1973, fig. 2c). 5, *E. grandifolia*.

remarks. I add the description of a new species, *E. patina*, and list the eastern Atlantic species.

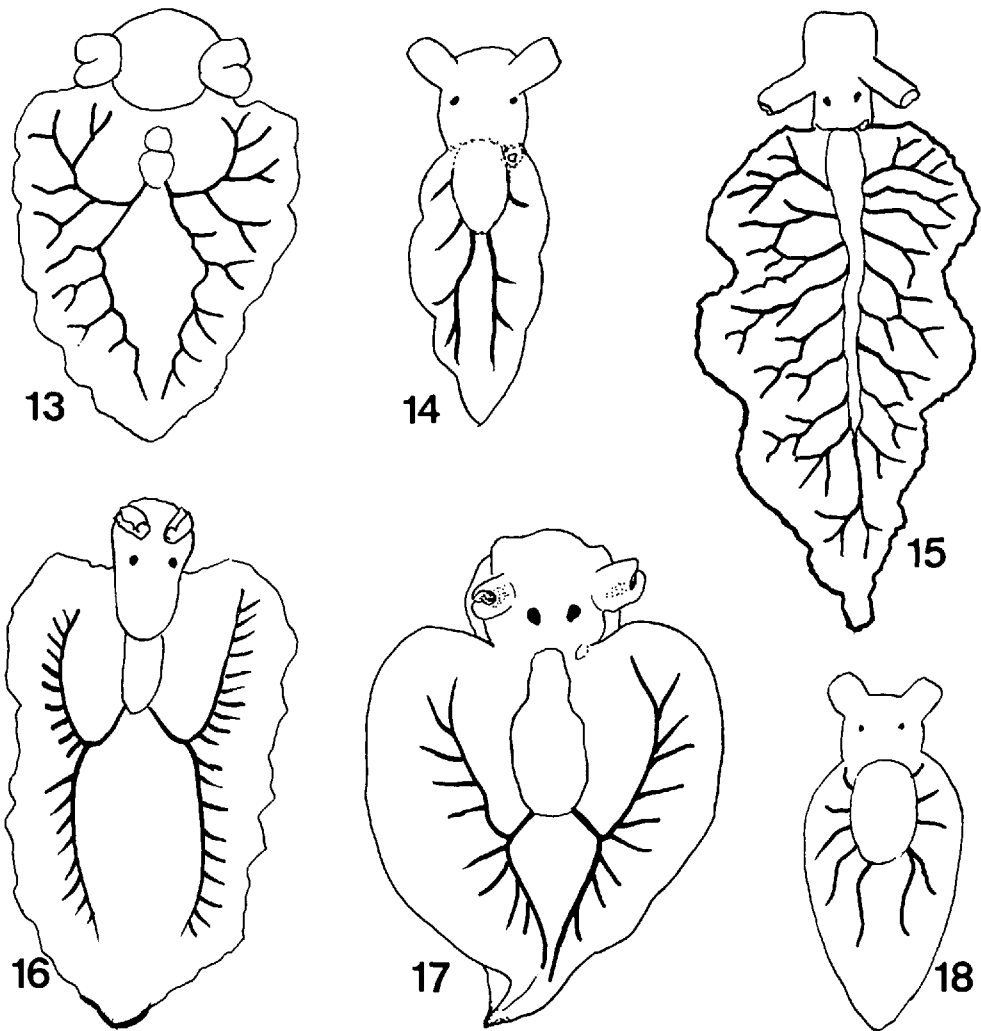
Though *Elysia viridis* (Montagu, 1804) and *E. halimeda* Macnae, 1954, are not western Atlantic, I treat them here too. *E. viridis* was for a long time the best studied more or less green species from European seas. It appeared in some lists as *viridis* also from other localities (Baba, 1936: 20, pl. 3, fig. 6, text-fig. 9; 1949:



Figures 6–12. Dorsal vessels of *Elysia*. 6, *E. chlorotica*. 7, 8, *E. catulus*. 9, *E. papillosa*. 10, *E. canguzua*. 11, *E. chitwa*. 12, *E. serca*.

34, 131, text-fig. 24, pl. 8, figs. 25, 26). Pruvot-Fol (1946: 31), though she distinguished Baba's species from *viridis* and called it *babai* (p. 38), still indicated the distribution of *viridis* as perhaps circumterrestrial. Baba in 1955 (p. 41, 55) gave his former *viridis* the new name *hirasei*, which is a junior synonym to *babai* Pruvot-Fol. In 1957 (10-69) Baba accepted *babai* but retained *hirasei* as well.

Elysia (*Elysiopertus*) *verrilli* Pruvot-Fol, 1946 (p. 39) for *Elysia crispata* Verrill (1872) is unnecessary, as there is only one Atlantic species of *Tridachia*, *crispata* Mörch, 1863. Pruvot-Fol reintroduced *Tridachia schrammi* Deshayes, 1857, whose parapodia resemble frilled chicory rather than frilled lettuce (footnote, p. 42). The criterion of different colors in *schrammi* and *crispata* cannot be applied, as the colors vary too much. The absence of zooxanthellae in *crispata*, present

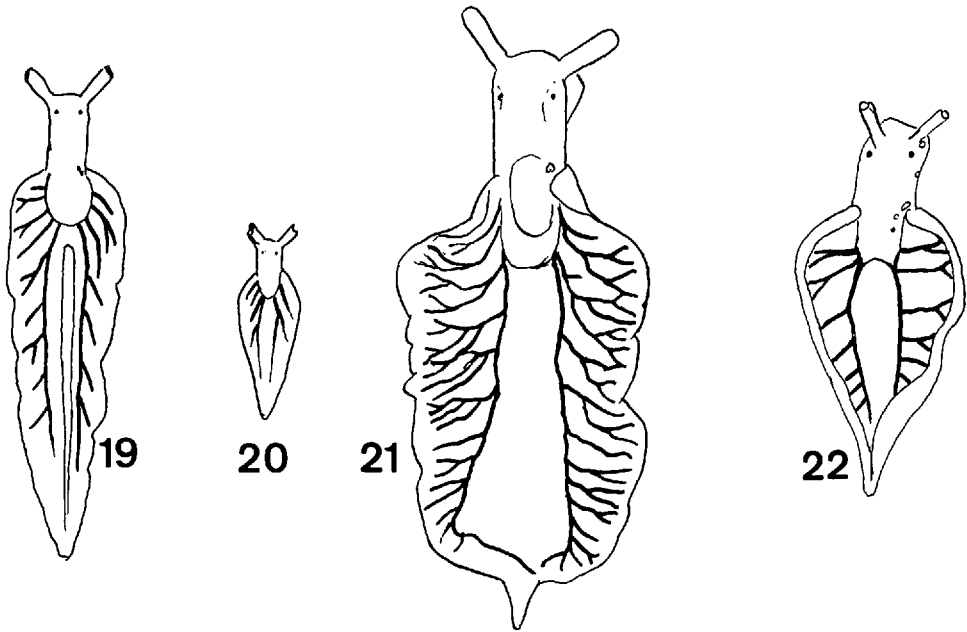


Figures 13–18. Dorsal vessels of *Elysia*. 13, *E. picta*. 14, *E. evelinae*. 15, *E. cauze*. 16, *E. tuca*, 10 mm. 17, *E. tuca*, 5.5 mm. 18, *E. clena*.

in *schrammi* (Marcus 1960a: 157) must have been a lapsus, the cited Yonge and Nicholas (1940: 297–300) have studied the zoochlorellae of *crispata* and never mentioned *schrammi*, which Engel (1927: 115) declared as *nomen nudum* and as synonymous to *crispata*, the only Atlantic species.

Already Pilsbry (1893–95: 242) stated: “It remains for those who have opportunity to observe living examples to properly classify many of the species.” Also Thompson claimed (in a letter) that Elysiids should always be observed alive. This holds for all shell-less opisthobranchs. As long as this is not feasible, color photographs are rather efficient substitutes, especially when unaccompanied by a scale.

An anatomical feature without systematic value I found in sections of the rhizophores, the inner side of which is folded like a Hancock’s organ, and innervated, so that it may be compared to such.



Figures 19–22. Dorsal vessels of *Elysia viridis*. 19, Specimen from aquarium, 45 mm long (from Hecht, 1895, pl. 1, fig. 1a). 20, Normal specimen from beach, 12 mm long (from Hecht, 1895, pl. 1, fig. 1b). 21, Specimen 45 mm long (from Thompson, 1976, pl. 9a). 22, Specimen from sketch by T. Gascoigne.

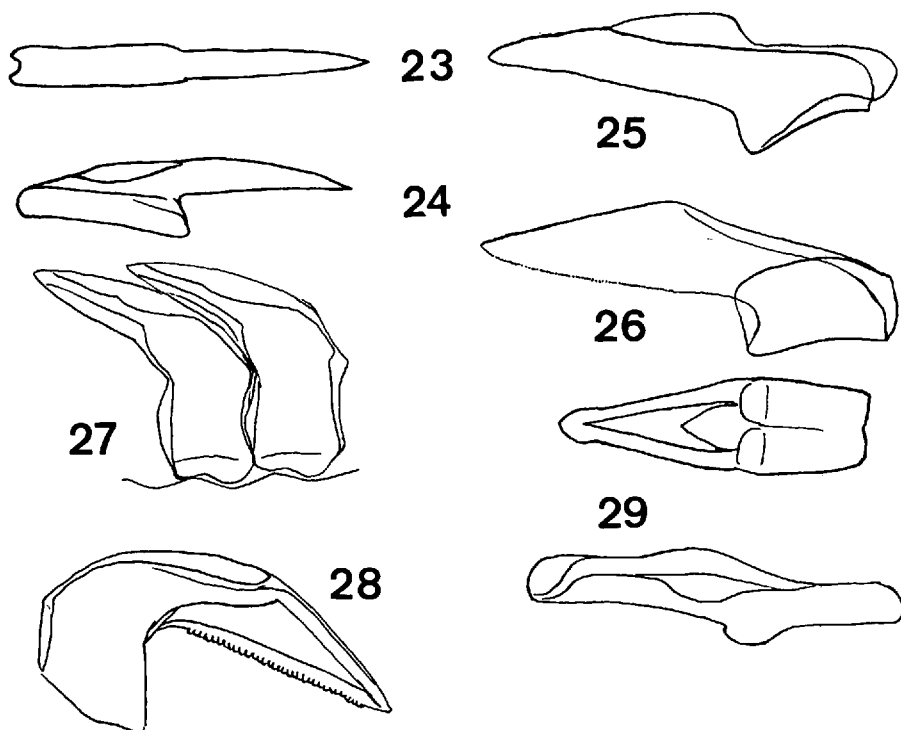
The Ascoglossa seem to be one of the most difficult groups; I have certainly contributed to the number of errors in synonymizing old species (1972a).

We stated 1955 (p. 112) that the separation of the species cannot continue on the basis of color, thickness, and extension of the parapodia, form of the head, and radula, and discussed the useful anatomical characters in 1970 (pp. 41–43).

DISTINCTIVE CHARACTERS

The often beautiful colors of the living animals may be distinctive, but in most cases the color is not decisive for the classification, as colors are frequently lost by preservation. Black pigment is generally preserved. Tubercles or papillae on the skin are variable in one and the same species. If papillae on head, rhinophores and parapodia are developed, they serve as a useful character, but they can be wanting in “papillose” species. The size of the animals differs from one population to the other.

The dorsal vessels are a reliable systematic feature. Thompson calls them gill lamellae (1977: 128). Bergh (1872: 179) already found them to be different in the different species and rather uniform in one and the same. We also stressed their systematic value (1970: 42–43, fig. 81). They are rarely figured in the literature (Meyer and Möbius, 1865; Bergh, 1872; Pelseneer, 1894; Hecht, 1895; Reid, 1964; Thompson, 1976). My comparison of numerous specimens of *E. ornata*, of *E. cauze*, and of *E. tuca* confirmed Bergh’s statement, but the number of vessels increases in larger specimens (Figs. 1, 3; Figs. 15, 17). In the case of *viridis* there are two different aspects in the figures by Meyer and Möbius, 1865, Bergh (1872, pl. 20, fig. 14), and Thompson on one hand (Fig. 21), and a sketch by Thomas Gascoigne on the other (Fig. 22). I suspect, that their figures refer to different



Figures 23–29. Radular teeth of *Elysia*. 23, 24, *E. patina*, spec. nov. 25, 26, *E. chlorotica*. 27, *E. catulus*. 28, *E. serca*. 29, *E. evelinae*.

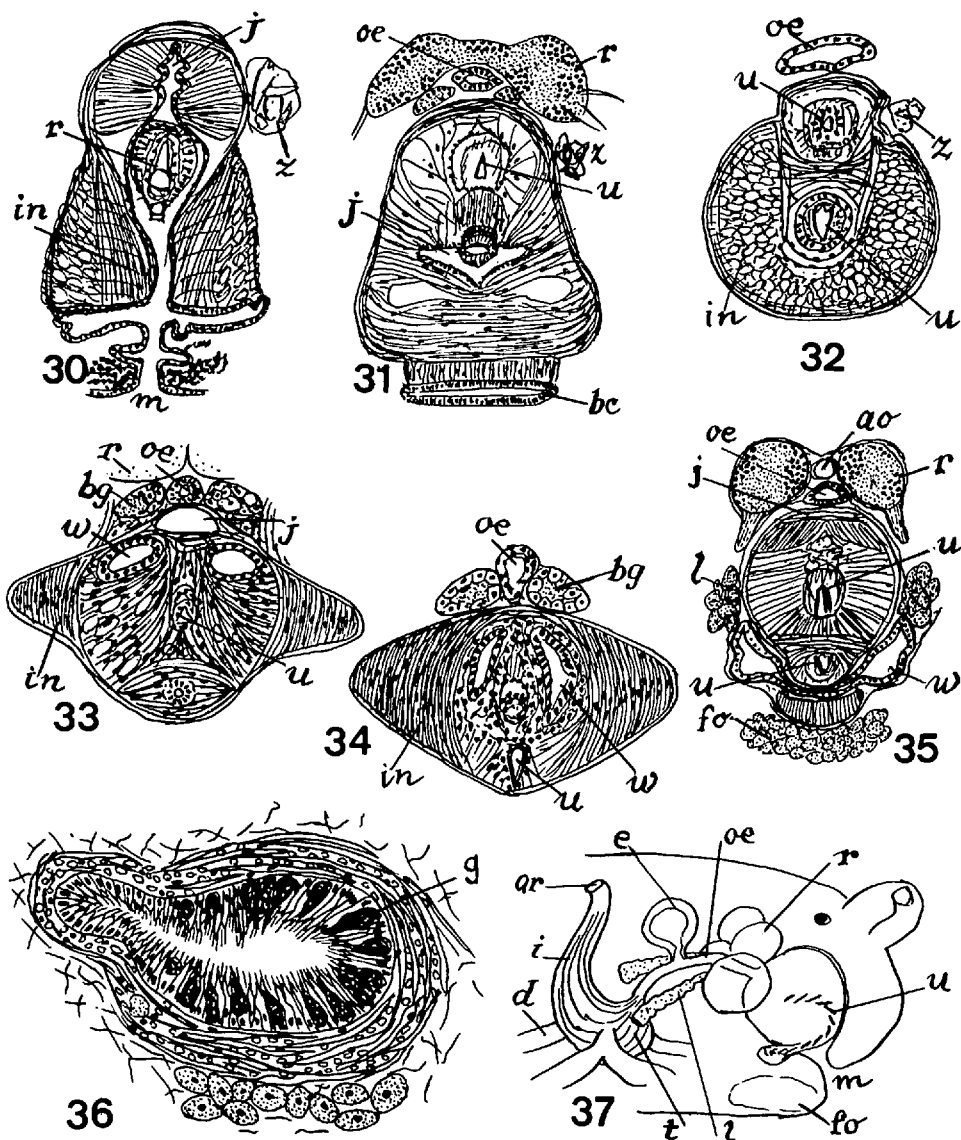
species, but that must still be proven by further anatomical features. Hecht (1895: 559, pl. 1, figs. 1a, 1b) observed increase of vessels in a specimen of *E. viridis* kept in the aquarium (Fig. 19), which had grown to double the size of those taken on the beach (Fig. 20).

In the small *Elysia chitwa* with thick but narrow parapodia the vessels are not salient (Fig. 11).

In *Elysia tuca* (Figs. 16, 17) the small vessels on the borders of the parapodia are high and crested. They are collected into an anterior and a posterior branch on either side, which in their turn unite to a right and a left principal trunk, these entering the renopericardiac eminence near its hind end. In *picta* these trunks are much shorter (Fig. 13) and quite short in *chlorotica* (Fig. 6). In *cauze* (Fig. 15), the renal eminence is very much prolonged tailwards, and a great number of vessels enter from the sides and one unpaired from behind. The vessels of *canguzua* (Fig. 10) and *evelinae* (Fig. 14) are rather similar, but *evelinae* has blunt teeth. In *chitwa* (Fig. 11) there are no prominent vessels. *Elysia serca* (Fig. 12) and *E. catulus* (Figs. 7, 8) both have numerous lateral vessels, but the hindmost ones unite to form an unpaired branch in *catulus*, while they remain paired in *serca*.

In *clena* (Fig. 18) the vessels enter the prominence separately. The posterior vessels unite to main trunks on both sides in *ornata* (Figs. 1–3), as in *marginata* (Fig. 4), but there are also anterior branches in the former, and most marginal vessels are bi- or multipartite or anastomosing, against *grandifolia* (Fig. 5).

The length of the renopericardiac prominence varies to a certain degree. It is



Figures 30-37. Pharynx and esophagus of *Elysia*. 30-32, Transverse sections of pharyngeal ingluvies of *E. catulus*. 33, 34, Same of *E. picta*. 35, Pharyngeal pouches of *E. evelinae*. 36, Esophageal pouch of *E. patina*. 37, Diagram of digestive tract of *E. chitwa* (ar—anus, bc—buccal cavity, bg—buccal ganglion, d—digestive gland, e—esophageal pouch, fo—foot gland, i—intestine, j—pharyngeal cavity, l—salivary gland, m—mouth, oe—esophagus, r—nerve ring, t—stomach, u—radula, w—pharyngeal pouch, z—ascus).

always very long in *E. cauze*. Eliot (1908: 97) found it considerably prolonged in two of his specimens of *grandifolia*, in the third less noticeable, and the organ was constricted in the middle. Perhaps his material was not homogeneous.

The radula shows important features, though the shape of the ascus may change according to treatment. After cleaning the radula in caustic potassium, the ascus sometimes uncoils when placed in water; in another case it formed a double spiral (Marcus, 1963: 22).

The fine denticulation of the teeth is sometimes lost by prolonged preservation (Engel, 1927: 114–115). Coarse denticles are generally preserved (Fig. 28), even when the radula dries. Presence or absence of denticles may occur in one and the same species. The pointed or rarely blunt tip (Fig. 29) of the teeth is a good character.

The best distinctions are found in serial sections. The pharynx has (Figs. 30–34) or does not have a ventral muscular ingluvies, sometimes called a pharyngeal crop; the presence or absence of a more or less muscular esophageal crop or pouch is also specific (Fig. 36, 37). A pair of pharyngeal pouches is known for *Elysia picta* Verrill, 1901 (Figs. 33, 34, w) and *E. evelinae* Marcus, 1957 (Fig. 35).

Pruvot-Fol (1946: 35) considered the presence of an ingluvies as incompatible with the genus *Elysia*. This good character might in future serve as a generic distinction. However, the structure of the ingluvies I have seen, (Figs. 30–34), is different from one species to the other, and there are still so many species, whose pharynx is not known, that it is too early to separate them now. Moreover, the terms ingluvies, pharyngeal crop, and esophageal crop or pouch, another rarely mentioned organ, have not been used uniformly.

In *Elysia cauze* we found (1957: 407, fig. 44, 5b) a spherical organ in front of the heart and compared it with the blood gland of the doridids. In *E. tuca* there is a similar organ between the mucus gland and the heart.

The reproductive organs afford some useful traces. The ovotestes generally contain sperm and ovicells; in *E. ornata* they are separate as in *E. maoria* (Reid, 1964: 362). The ampulla of the hermaphrodite duct is generally intercalary. In *E. patina* it is dependent, and in *ornata* multiple in the ductules (Marcus, 1970, fig. 83, aa).

The further course of the ducts and their confluences are extremely difficult to trace, especially in adult females, whose mucus gland swells over its limits during staining. Pelseneer's diagrams (1894, e.g., figs. 180, 187) are not quite well interpreted. These details, except for the number of genital openings, have no systematic value.

The complication of the branched annexed prostatic and albumen glands in *Ascoglossa*, and their cells staining variously according to their position, were described for *Bosellia corinneae* (Marcus, 1973: 818, fig. 8). In my first reconstructions of the reproductive organs (1955: figs. 58–60) I did not completely follow the branching glands and drew them simplified, opening into the oviduct. In the subsequent paper (1957: 408, 411, figs. 42, 57) they were traced correctly.

In a single slug of *E. ornata* (Fig. 3) and in one 6-mm specimen of *tuca*, the largest of which were 10 mm preserved, as well as in the single *E. grandifolia* (Fig. 5) and in the sectioned *E. patina* (Fig. 43) I found a pair of more or less prominent dorsal vesicles between the lateral branches of the vessels, the right one a little farther in front than the left one. These evidently serve as spermatolytic organs.

Reid (1964: 373, figs. 2, 5) found 4–8 bursal sacs in *E. maoria* Powell, 1937. Their contents are active sperms mixed with secretions, different from the contents of the present sacs and of the multiple dependent ampullae of *ornata*. The epithelial cells (fig. 5a–h) are similar to those in my sections of *patina* (Fig. 43), and so are the ducts (fig. 6C, bd). Reid described impregnation of sperm in *maoria*, while the present species all have a spermatheca connected to the female pore by a permanent duct.

The shape of the penial papilla is recognizable by simple dissection (Fig. 43), but it depends upon the degree of contraction or evagination. If a cuticular stylet is present, this is helpful.

A widening of the male duct just before entering the penial papilla was described for *E. viridis*. Such a wide vesicle occurs in the base of the papilla in *E. catulus*, and in the middle of the penis in *E. patina*.

Biological Observation

Some species of *Elysia* have been recorded only from *Halimeda*, others are polyphagous, and feed on *Codium*, *Caulerpa*, *Thalassia*, *Zostera*, and others.

Elysia ornata (Swainson, 1840)

Figures 1–3, 38, 44

Thallepus ornatus Swainson, 1840: 183.

Elysia ornata Verrill, 1901: 28, pl. 4, fig. 5; Engel, 1927: 115, fig. 32; Pruvot-Fol, 1946: 32; Marcus, 1957: 414; 1963: 20, figs. 27, 28, 64; 1970: 43, figs. 81–83; d. B.-R. Marcus, 1972a: 292, fig. 18; 1976a: 128; Marcus and Hughes, 1974: 507, fig. 17; Bandel, 1976, fig. 8 (spawn). Thompson, 1977: 126, figs. 25d, e, 26a.

Non *Elysia ornata* Pease, 1860 (*E. marginata* Pease, 1871).

Distribution.—Miami; Bermuda; West India; Curaçao; Colombia. The animals were found on *Caulerpa*, *Thalassia*, and *Sargassum*.

Descriptive Remarks.—Alive the largest was 5 cm long, preserved 16 mm. The colors of the living animal vary according to the alga they feed upon and to the filling of their digestive glands. Well fed animals were green with a black margin; hungry ones had a more orange ground color. The black stipples are round and surround glandular pores (Fig. 38, og) in some specimens, irregular and up to 0.3 mm in diameter in others. Engel described them very appropriately: finely dotted like pencil drawing on rough paper. Their distribution on the head, dorsal side and sole is variable.

The dorsal renopericardiac prominence is transversely divided. One pair of afferent vessels enters the anterior part (Fig. 1), one or two go into the posterior one in front of the pair of principal trunks. These have received several (3–7), sometimes (Fig. 2) anastomosing branches.

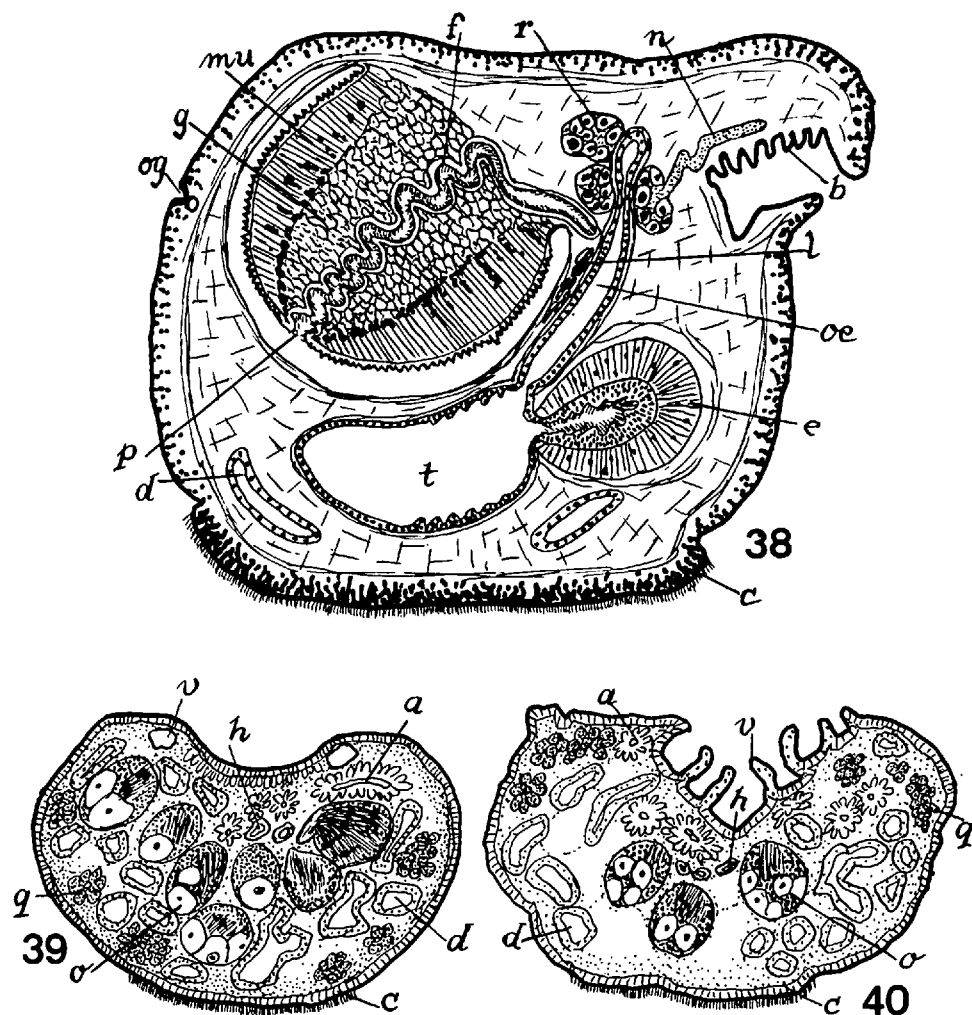
The pharynx is strongly muscular. The smooth radular teeth are of the pointed type. In the esophagus a section with thickly muscular walls corresponds to a dependent pouch.

The gonadal follicles produce either ova or sperm, as in *Elysia maoria* (Reid, 1964: 362). Their outlets are provided with a number of dependent ampullae, Reid's bursal sacs, filled with sperm (Marcus, 1970: 43, fig. 83, aa). Sperm are absent in a slight widening of the hermaphrodite duct.

In the largest preserved animal there are two salient vesicles on the back (Fig. 3), the right a bit farther forward than the left one. This character corresponds to the bursal sacs in *E. maoria* (Reid, 1964: 372).

Discussion.—The Pacific *Elysia ornata* described as *Pterogasteron ornatum* by Pease (1860: 36) and later as *P. marginata* (1871: 304), was generally considered to be synonymous with the Atlantic one (Bergh, 1881: 79, pl. G, fig. 18; 1905: 84, pl. 2, fig. 20, pl. 13, fig. 28; Risbec, 1928: 280, fig. 94; 1953: 168, fig. 121D; Allan, 1947: 439, pl. 41, fig. 7; Baba, 1957: 72, pl. 3, fig. 5, pl. 4, fig. 6a, b; Burn, 1972: 177; Thompson, 1973: 247, figs. 2c, 3g; 1977: 126, figs. 25d, e, 26a. It was reported from New Caledonia to Hawaii. The name *marginata* Pease can remain with this species.

In 1972a (p. 292) I copied Baba (1966: 201–202) who, following the suggestion of J. Gonor, synonymized *E. grandifolia* Kelaart, 1858, and its var. *orientalis*



Figures 38–40. 38, Combined transverse sections of anterior region of *E. ornata*. 39, Transverse section behind region of renopericardiac prominence of *E. chitwa*. 40, Same of *E. serca* (a—albumen gland, b—folds in rhinophore, c—ciliated sole, d—diverticula of digestive gland, e—esophageal pouch, f—efferent duct, g—glands, h—hermaphrodite ductules, l—salivary gland, mu—penial muscle layer, n—rhinophoral nerve, o—ovotestis, p—penial aperture, r—nerve ring, t—stomach, v—dorsal vessels).

Baba (1957: 72), as well as *E. marginata* (Pease, 1871) and its var. *minor* Baba (1957: 72), with *E. ornata* (Swainson, 1840). The suspected difference between Atlantic and Pacific *ornata* was based upon a white band on the border of rhinophores and parapodia between the outermost black and the innermost orange or red stripe in the Pacific material. However, in several descriptions this white band is not mentioned (Bergh, 1905: 84, a 4-cm long specimen; Eliot, 1908: 96, in a 3-cm long animal; Baba, 1957, 12–40 mm; Burn, 1972: 177, in a 100-mm long slug).

As I am now adopting the character of the vessels for specific distinction, I must separate the only specimen of *grandifolia* I have from the Red Sea (Fig. 5) of equal size with the largest *ornata* (Fig. 3), due to its less numerous vessels. So it remains with the name *grandifolia* Kelaart, 1858. It was collected by Prof.

Gerlach in the Red Sea, Sarad Sarso, Farasan Archipelago, 16°50'N, 41°32'E. XII. 1964. It has a much larger head than the *ornata* of equal size. The indication of denticulated (Eliot) or smooth teeth (Baba, 1957: 72) is as contradictory as for *ornata*.

Elysia grandifolia Kelaart, 1858, was previously collected at Ceylon (Kelaart, 1858: 493), Okhamandal (Eliot, 1908: 114) and southern India, Gulf of Manaar (O'Donoghue, 1932: 141).

Elysia chlorotica Gould, 1870

Figures 6, 25, 26, 45, 46

Elysia chlorotica Gould, 1870: 285, pl. 17, figs. 251–255; Verrill, 1873: 667, pl. 25, fig. 171; Russell, 1946: 96; 1964: 37; Pfitzenmeyer, 1960: 114; Miller, 1961: 99; Bailey and Bleakney, 1967: 353; Franz, 1968: 7; d. B.-R. Marcus, 1972: 308, fig. 5A–D; Clark, 1975: 42; Clark et al. 1975: 793.

Distribution.—From Nova Scotia to Florida.

The present specimens are from the west coast of Florida, Treasure Island, Susan B. Gallagher leg., and from Miami, Bear Cut, Lt. Col. Corinne E. Edwards leg.

The polyphagous animals appear to prefer lower salinity. They were found on *Caulerpa*, *Cladophora*, *Enteromorpha*, *Halimeda*, *Ruppia*, *Ulva*, *Vaucheria*, and *Zostera*.

Descriptive Remarks.—The preserved animals are about 7 mm long. They have lost most of their pigmentation. Color photographs from Noank, Mass. (Kerry B. Clark) and Chesapeake Bay are dark with round white spots, evidently glandular outlets. The ochre color of some specimens from Chesapeake Bay was probably due to their being kept without food. Those from Florida are dark with light parapodial edges and irregular white stipples on the outer side.

The dorsal vessels (Fig. 6) are in the 7-mm long slug less numerous (nine on either side) than in the 22-mm specimen from Chesapeake Bay (13 on either side). The teeth are of the slender, pointed type (Figs. 25, 26).

There is a dependent pouch on the esophagus.

The penial papilla (Fig. 46) is about 0.8 mm long. From its insertion, 0.5 mm in diameter, it diminishes gradually to the tip. The efferent duct inside it is winding in its course. There is no stylet. In one specimen it was spirally coiled in its sheath (Fig. 45).

Elysia catulus (Gould, 1870)

Figures 7, 8, 27, 30–32, 47

Placobranchus catulus Gould, 1870: 256, pl. 17, figs. 249, 250.

Elysiella catulus Verrill, 1873: 668, pl. 25, fig. 172.

Elysiella catula Bergh, 1886: 17, pl. 1, figs. 17–19, pl. 3, fig. 15 (vessels), pl. 4, figs. 8–11, pl. 5, figs. 1, 2.

Elysia catula Franz, 1968: 7.

Elysia catulus d. B.-R. Marcus, 1972: 310, fig. 6A–F; Clark, 1975: 41.

Synonymy.—*Elysia* (*Elysiella*) *verrilli* Thiele, 1931: 415.

Distribution.—From northern New England to North Carolina; Florida (letters from Kerry B. Clark, 6/28/1976 and 6/6/1977). The animals feed on *Zostera* (Clark).

Descriptive Remarks.—The small slugs, about 3 mm long, have thick and short

parapodia. Their rhinophores are light, and generally there is a pair of white spots in the middle of the parapodial margins.

The dorsal vessels (Figs. 7, 8) are similar to those of *E. serca* (Fig. 12), but the hindmost is unpaired in *catulus*, paired in *serca*.

The penial papilla (Fig. 47) is slender and narrows gradually.

The smooth teeth stand on their hind ends (Fig. 27) away from their membrane, not parallel to it. The shape of the teeth, similar to those of *chitwa*, distinguishes *catulus* clearly from *E. serca*, the dorsal vessels of which are like those of *catulus* (Fig. 12).

The pharynx is surrounded by a muscular ingluvies (Figs. 30–32). Its ascus lies high on the right side, higher than Pruvot-Fol figured it for *E. viridis* (1958: 115, fig. 8).

Elysia subornata Verrill, 1901

Verrill, 1901: 29, pl. 4, fig. 4; Pruvot-Fol, 1946: 33.

Distribution.—Bermuda.

Description.—Verrill indicated that the slugs, 25 mm in length, are covered with scattered verrucae. Their ground color is olive green mottled with greyish white. They have a fine orange brown line close to the edge, the extreme edge is darker brown; proximal to the rhinophores is a grey patch. The head is large, one third of the total length. There are dendritic and inosculating dorsal vessels.

Remarks.—Verrill distinguished *subornata* from *ornata* by its papillose surface, and appearance later in the year; Pruvot-Fol synonymized it to *ornata*. In my opinion it is most similar to *Elysia tuca*.

Elysia flava Verrill, 1901

Elysia flava Verrill, 1901: 11, pl. 4, fig. 1; Thompson, 1977, 124, figs. 25a, 26c.

Distribution.—Bermuda; Jamaica; Porto Rico.

Description.—Verrill reports light yellow animals with white specks and faint dull brown markings on head and neck. The flaps are olive green with white specks, minute papillae, and white edges with dendritic branches of white extending inwards. The inner surface is almost black.

The head is small, about one fourth of the body length.

Remarks.—The *Elysia* sp. (Marcus, 1967: 32) from the Caribbean side of the Panama Canal Zone is similar to the description of *E. flava*. Thompson described specimens from Jamaica, and I obtained a photograph from Puerto Rico from Germaine Warmke.

Elysia picta Verrill, 1901 Figures 13, 33, 34, 54

Elysia duis Marcus, 1967.

Elysia picta Verrill, 1901: 30, pl. 4, fig. 2; *Elysia duis* Marcus, 1967: 31, figs. 33–37; 1970: 47, figs. 81, 86–88; *Elysia picta* Thompson, 1977: 129, pl. 1f, figs. 26g, 27c, d, e.

Distribution.—Bermuda; Florida and Keys; Curaçao, on *Halimeda*.

Description.—This colorful species was found 15–16 mm long alive. The head is

light, the rhinophores have black and red bands. The footborder and the parapodial margins have red, black and blue bands over broad, white or yellow, often confluent blotches. The underside is dark with small white dots. The foot corners are prominent.

The length of the renopericardial eminence varies slightly. In some specimens it is shorter than in others, and then the principal trunks of the vessels unite in the midline and the resulting median vessel enters the renopericardial eminence from behind. The teeth are pointed with denticles on the under edge. The pharynx has a strong, muscular ingluvies (Fig. 33, 34), containing a pair of pouches as in *Bosellia mimetica* (Marcus, 1973, fig. 91). On the esophagus there is an esophageal muscular pouch.

Remark.—Thompson's material from Jamaica and Bermuda proved that *E. duis* Marcus, 1967, is a junior synonym to *picta*.

Elysia papillosa Verrill, 1901

Figures 9, 48

Elysia papillosa Verrill, 1901: 31, pl. 4, fig. 3; Marcus, 1967: 27, figs. 22–25; 1970: 45.

Non *E. papillosa* Marcus, 1963: 21 (*E. tuca* Marcus, 1967).

Distribution.—Bermuda; Florida; Curaçao. The Florida animal was taken on *Halimeda*.

Descriptive Notes.—Verrill described the living, 12 mm long animals as thickly covered with small greyish blue, conical papillae and spotted with darker grey on the outer side of the flaps. The edges are bordered with white.

The preserved, 9-mm long specimen corresponded to this description; the back of head and neck was white.

The renopericardiac prominence is elliptical and receives one pair of principal trunk vessels from behind, whose branches are simple (Fig. 9). The pointed teeth have coarse denticles.

The penial papilla (Fig. 48) is muscular, 0.7 mm long and 0.3 mm in diameter. The winding male duct ends with a triangular stylet, 0.06 mm long. Verrill mentioned that the animals swim.

Elysia canguzua Marcus, 1955

Figures 10, 49

Elysia canguzua Marcus, 1955: 111, figs. 45–48, 60–65; 1957: 415, fig. 47.

Distribution.—Brazil, coast of São Paulo; on *Codium* and other algae.

Descriptive Notes.—The maximum length of the smooth living animals was 9 mm. They are of a lively green color due to the contents of the diverticula of the digestive gland. There are bright red and brilliant blue spots as those found in many species of *Elysia*. Black pigment occurs on the inner side of the rhinophores, on the edges of the flaps and on the lips. The dorsal vessels are two principal trunks (Fig. 10) with simple branches, and one branch may enter the short renopericardiac prominence.

The radular teeth are short and pointed, they have a very fine serrulation. There is no muscular ingluvies, but an esophageal pouch.

The wide and short penial papilla of *canguzua* (Fig. 49) is different from the long and narrow ones of the other species of *Elysia* described here. The outer

epithelial cells are intermingled with vacuolized ones. The wide space between epithelium and efferent duct is filled with glandular cells of different sizes, staining differently with haematoxylin-eosin. Some are more basophilous, others slightly acidophilous. I could not find out where they open, some seem to be attached to the outer surface of the papilla, others to the efferent duct, but a great number in between did not show the direction of their secretion.

Similar gland cells occur under the skin on the ventral as well as, less numerous, on the dorsal side of the body, the epithelial ones measure 6–8 μm ; those in the connective tissue, 10–26 μm long, are connected to the surface; some eosinophilous glands are about 8 μm .

Elysia serca Marcus, 1955
Figures 12, 28, 40, 50

Elysia serca Marcus, 1955: 113, figs. 49–52, 59; 1957: 415, fig. 45; d. B.-R. Marcus 1970: fig. 8, non fig. 7 = *chitwa*; see 1976: 6; Hosoe, 1956: 1, pl. 1.

Distribution.—Brazil, from Recife to Cananea. The specimens feeding upon *Ulva* were green, those from Phaeophyceae were brown.

Descriptive Notes.—The living slugs were 8 mm long, preserved they contracted to 3.5 mm, and the pharynx was 0.6 mm long.

There is neither an ingluvies nor an esophageal pouch.

Up to eight vessels arise from the inner border of the parapodia on either side (Fig. 12). They are not symmetrical and some may unite. The anterior ones run directly to the pericardiac hump, while the posterior ones open into two parallel main vessels. In sections these vessels stand high over the back (Fig. 40).

The teeth (Fig. 28) are coarsely serrulated and lie parallel to their membrane, different from the vertical ones of *catulus*.

The penial papilla is wider in its ectal third than in its beginning and narrows towards the tip (Fig. 50).

Remark.—The species is very similar to *Elysia catulus*, it differs by coarsely serrulate teeth and two principal trunk vessels receiving lateral branches, entering the prominence from behind.

Elysia chitwa Marcus, 1955
Figures 11, 37, 39, 51

Elysia chitwa Marcus, 1955: 115, figs. 53–56, 58; 1957: 415, fig. 46; d. B.-R. Marcus, 1970: fig. 7 (non fig. 8 = *serca*, see 1976: 6).

Distribution.—Brazil, coast of São Paulo, on algae.

Descriptive Notes.—The slugs are preserved about 2 mm long. They are smooth and their afferent vessels do not show (Figs. 11, 39). The green color is produced by the digestive gland. There are red dots. Black pigment occurs in the inside of the rhinophores, between mouth and rhinophores, and in the furrow in front of the parapodia.

The radular teeth are stout and pointed. There is an esophageal pouch (Fig. 37). The penial papilla is almost cylindrical till near its tip (Fig. 51). In evaginated state it is more than 1 mm long.

Remark.—The smooth back is an uncommon feature of *Elysia*.

Elysia cauze Marcus, 1957
Figures 15, 52

Elysia cauze Marcus, 1957: 405, figs. 35–44; 1960a: 153, fig. 34; 1963: 22; 1970: 44, fig. 81; Marcus and Hughes, 1974: 505, figs. 13, 14; Thompson, 1977: 124, figs. 25h–j, 26f.

Elysia cauze scops Marcus, 1967: 28, figs. 26, 27; eliminated 1970: 45.

Elysia aff. *cauze* Kay, 1964: 195, text fig. 2, pl. 9, fig. 3.

Distribution.—From Florida and the Antilles to Brazil, São Paulo; Hawaii.

The animals are all reported from *Caulerpa*.

Descriptive Notes.—The large slugs, up to 40 mm alive, are preserved up to 22 mm long. They are brownish or greenish grey with black rings around the outlets of skin glands, and with black pigment on the lips and generally on the edges of the parapodia. The rhinophores and the outer side of the parapodia are beset with warts. White spots occur on the back and on the tips of the warts.

The renopericardial prominence forms a long roll along about three quarters of the body length (Fig. 15). This is entered by many, sometimes anastomosing, vessels, which do not unite to main trunks.

The pharynx is very large (Marcus 1957: 408, fig. 43), 2 mm long in a big specimen, 1 mm in a 7-mm long one, but there are no ingluvies. The teeth are of the pointed type, with a more or less distinct serrulation. Due to this difference we separated (Marcus 1967: 28) a subspecies *scops* from *E. cauze cauze*, but later eliminated it again (Marcus 1970: 45), as the range of both coincides. The ascus even in a specimen not treated with KOH is quite straight from the first tooth, 9 μ m long, to the last in the lower limb, 170 μ m long. The largest complete tooth was 230 μ m long. A minute serrulation could be guessed on it. On the esophagus there is a muscular pouch (Marcus 1957: fig. 43).

The shape of the unarmed penis is in retracted state short and thick (Fig. 52). Protruded it is up to 2 mm long in large specimens, with a diameter of 0.4 mm, narrowing gradually towards the tip.

Engel (1927: 114) described the branching of the dorsal vessels in his four specimens of *E. ornata*. In specimens b and c he found "a narrow crest, from which the lateral branches emerge, behind the ovate eminence." This description agrees with that of the vessels of *E. cauze*; these are an exceptional feature of the species.

Elysia evelinae Marcus, 1957
Figures 14, 29, 35, 53

Elysia evelinae Marcus, 1957: 410, figs. 48–57; 1960a: 153, fig. 35; 1967: 27.

Distribution.—Florida, on unclassified algae, and Brazil, São Paulo, on *Dictyota*.

Descriptive Notes.—The living up to 8 mm long specimens are greyish and have a dark nuchal spot, especially developed around the anal opening, preserved in alcohol.

The renopericardiac prominence is short. One or two dorsal vessels (Fig. 14) enter the prominence singly on either side; one pair from behind collects a few lateral branches.

The radular teeth have a blunt tip and no denticles (Fig. 29).

The pharynx (Fig. 35) has a pair of lateral epithelial pouches (w).

There is neither a muscular ingluvies nor an esophageal pouch.

The retracted penis (Fig. 53) is wide near its origin and narrows from its middle towards the tip. It is unarmed.

Discussion.—Two other species of *Elysia* have been described with blunt teeth. Bergh (1872: 185, pl. 22, fig. 25) figured a tooth of *E. minuta* Sars, 1835, from Finmark to Norway, from Sars' original specimens. He called the tooth strangely clipped ("Eigenthümlich abgestutzt").

Baba's figure of *E. japonica* Eliot (1949: 35, text fig. 25, p. 131, pl. 9, fig. 27) called *amakusana* in 1955 (pp. 12, 35) shows rather blunt teeth with serrulation. In 1955 Baba gave his *viridis* of 1949 (text fig. 24, pl. 8, fig. 26) the new name *abei* (1955: 11, 42, text fig. 10). This text figure has quite blunt teeth, while his former *viridis* (1949, text fig. 24, p. 34) has pointed and smooth teeth. The latter *viridis* was named *babai* by Pruvot-Fol (1946: 38).

In Abe and Baba (1964) *abei* has two color pictures: pl. 10, fig. 35 is green as *viridis* in 1949, fig. 26; pl. 10, fig. 36, is reddish brown. Both have black rhinophores and tail tips. Figure 37 (pl. 10) represents *amakusana*, is red, stippled with white spots, similar to figure 27 (1949, pl. 9). In none of his papers (1949, 1953, 1957, 1964) does Baba refer to the differences in the shape of the teeth.

Elysia tuca Marcus, 1967

Figures 16, 17, 55

Elysia papillosa Marcus, 1963: 21, fig. 29;

Elysia tuca Marcus, 1967: 29, figs. 28–32; 1970: 46, figs. 81, 84–85; d. B.-R. Marcus, 1976: 12;

Marcus and Hughes, 1974: 507, figs. 15, 16; Thompson, 1977: 128, figs. 26c, 27a, b.

Distribution.—Florida, Miami; Puerto Rico; Curaçao; Brazil, Recife and Salvador, Bahia (Yara Leite leg.).

The animals are generally reported on *Halimeda*, but also on *Caulerpa*, *Thalassia*, and *Penicillus*; but they overwhelmingly prefer *Halimeda* (letter of Kerry B. Clark, 2/17/1977).

Descriptive Notes.—The largest slugs were 15 mm alive; 10 mm long preserved. They are often beset with light papillae. The colors vary from very light to dark green or brown, probably according to their food. On the back of the head there is a white cross-shaped figure, on the neck a white triangle. The edges of the parapodia are white or beige, there is often a dark spot in the middle on both edges. Preserved specimens have dark inner sides of the large rhinophores, and a black margin of the tip of the tail, where the parapodia meet.

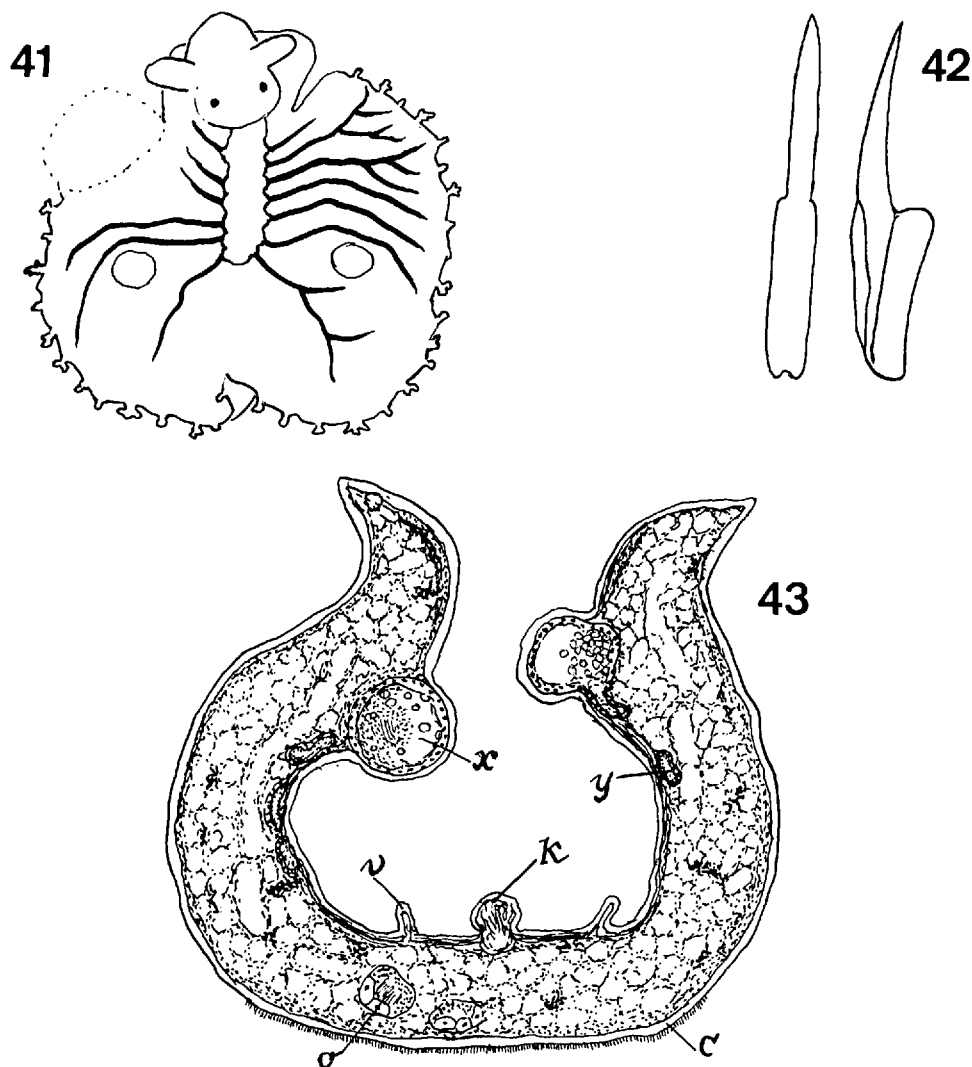
The renopericardiac prominence varies in shape from round to elongate and may be almost half the length of the body. There is always only one principal vessel on either side (Figs. 16, 17). Their anterior and posterior branches collect a number of simple short vessels, which stand out as in *serca* (Fig. 40).

The pharynx has no muscular ingluvies. The teeth are slender and pointed, sometimes coarsely serrulate, sometimes with fine denticles, sometimes smooth. The strongly muscular esophageal pouch is in some animals stretched, making part of the esophageal wall.

The penis (Fig. 55) is about 1 mm long and 0.15–0.3 mm wide in its ental part. Near its tip it diminishes suddenly and ends with a narrow cylindrical section, in which a 0.06 mm long cuticular tube with several folds standing out is lodged. Once two spermatolytic vesicles were found in a 6-mm slug.

Remarks.—The most characteristic feature of *E. tuca* is the branching of the dorsal vessels. It was recognizable already in a 2.5-mm long animal which had seven branches on either side. The number of the outer branches varies, but may be smaller in larger slugs than in smaller ones.

Of the similar species *E. subornata* Verrill (1901: 29, pl. 4, fig. 4), 25 mm long



Figures 41-43. *Elysia patina*, new species. 41, Dorsal aspect of preserved animal. 42, Teeth. 43, Combined transverse section on level of gametolytic vesicles (c—ciliated sole, k—kidney, o—ovotestis, v—dorsal vessels, x—gametolytic vesicle, y—duct of same).

alive, has a light spot on the head and is brown. Its parapodia have dark brown edges; its anatomical features are not known. We first took *tuca* for *E. papillosa* Verrill (1901: 31, pl. 4, fig. 3), which also lives on *Halimeda*, but later found the true *papillosa* (1967: 27). As similar as the two species are, their dorsal vessels are quite different (Figs. 9, 16).

As Macnae described *Elysia halimeda* from South Africa (1954: 57, text fig. 2, pl. 3, fig. 2), I compared it with *tuca*. It is up to 20 mm long and has short and broad, subrectangular parapodia, ending in front of the long and broad tail. (A similar shape occurs in *E. latipes* Marcus, 1960: 26, figs. 36-38, from the Maldives). Baba's *Elysia halimeda* from Japan (1955: 70, pl. 3, fig. 1, pl. 4, figs. 1a, 1b) and Burn's (1972: 177, fig. 10) differ from Macnae's species by papillate

rhinophores. Hence they are a different species, to which I give the name *Elysia macnaei* new name. Neither Macnae nor Burn gave anatomical details; Baba figured the radula with smooth, pointed teeth.

Elysia clena Marcus, 1970
Figures 18, 56

Elysia clena Marcus, 1970: 49, figs. 81, 89–90; d. B.-R. Marcus, 1970: 210, figs. 3–6; 1972: 312; Marcus and Hughes, 1974: 507, figs. 18–20.

Distribution.—Barbados, on *Thalassia*; Curaçao; Brazil, Recife.

Comparative Remarks.—The preserved specimens are 2 mm long; the species is similar to *E. chitwa* and *E. catulus*. From both it is distinguished by the dorsal vessels (Fig. 18), not visible in *chitwa*, much more numerous in *catulus*. The eyes of *clena* are 60 μ m in longest extension, those of *chitwa* of equal size, 100–170 μ m. The pharynx of *clena* is 0.5 mm long, the longest teeth, 0.09 mm, those of *chitwa* are 0.05 mm in a pharynx of 0.25 mm length. The compact shape of the teeth is alike in *clena* and *catulus*. The teeth are more slender in *chitwa*. The unarmed penis (Fig. 56), similar in shape, is retracted 0.3 mm long in *clena*, 0.5 mm in *chitwa*.

Elysia patina new species
Figures 36, 41–43, 57, 59–60

Material.—Florida, Keys, 22.X.1969, Among many *E. tuca*, one specimen, preserved.

Type Specimen.—A series of 10 slides, USNM 770515.

Description.—Except for the *patina* color no indications of the living slug were noted during the sorting of the day's collection. The preserved animal measured 8 by 7 mm with spread parapodia. It resembles the Pacific *E. lobata*. Head and neck are short; the anterior part of the foot is delimited by a deep furrow from the posterior one. The rhinophores are short, evidently contracted. The parapodia are joined in a little pointed tail. Their edges bear irregular branching papillae (Fig. 41). A part of the left one is damaged.

The color of the animal fixed in Bouin and preserved in alcohol is greyish with a loose network of darker grey spots. The ciliated sole (Fig. 43c) is lighter. It is as broad as each of the parapodia and provided with many basophilous glands.

The round eyes are very big, 0.12 mm in diameter.

The renopericardiac prominence (Fig. 41) is little less than half the length of the parapodia. Seven vessels enter on the right, six on the left side; only three on the right side are branched, the corresponding ones on the left side are damaged.

Between the two hindmost vessels there is a salient, globular thickening on either side, in sections a vesicle (Fig. 43, x), probably functioning as gametolytic vesicles.

The male aperture lies in the groove separating head and right parapodium. The single female pore opens immediately behind the anal opening.

The pharynx is about 0.4 mm long. It is muscular but has no ingluvies. The smooth teeth (Fig. 42) are very slender. There is a muscular pouch on the esophagus (Fig. 36).

The penial papilla (Fig. 57) is about 0.47 mm long and 0.3 mm wide. The winding efferent duct widens from 0.035 to 0.12 mm in the middle of the papilla and narrows suddenly towards the tip, which is provided with a very delicate cuticular tube of 0.06 mm length.

The prostatic and albumen glands are ramified through the whole body. Both extend forward to the anterior border of the parapodia. The farther dorsal and ventral ones have only basophil granules, 2–3 μm in diameter. They reach farther backwards than the more central ones. The latter have homogeneous acidophil contents around their ducts, farther outwards the longer cells each contain a large vacuole filled with granules 5 μm in diameter, staining weakly. This type of gland ends near the end of the eminence, together with the hindmost ovotestes.

Discussion.—Though the living animal was not observed, the branching of the dorsal vessels is so far different from all the other known Atlantic species, that it is easily recognized as a new species. Also the papillate margin of the parapodia is a good character.

From Prof. Brattström, Bergen, I received one specimen from the Bahamas (39–67-C), taken in 1967. It is similar to the present one of *patina*, but without the marginal papillae and with different eyes and dorsal vessels (Figs. 59, 60). It measures 4.5 by 4 mm preserved. I do not want to give a name to this second species, but with more material the species with two gametolytic vesicles should be separated from the large genus *Elysia*, together with *E. ornata* (Swainson) (Fig. 3) and *E. grandifolia* Kelaart (Fig. 5).

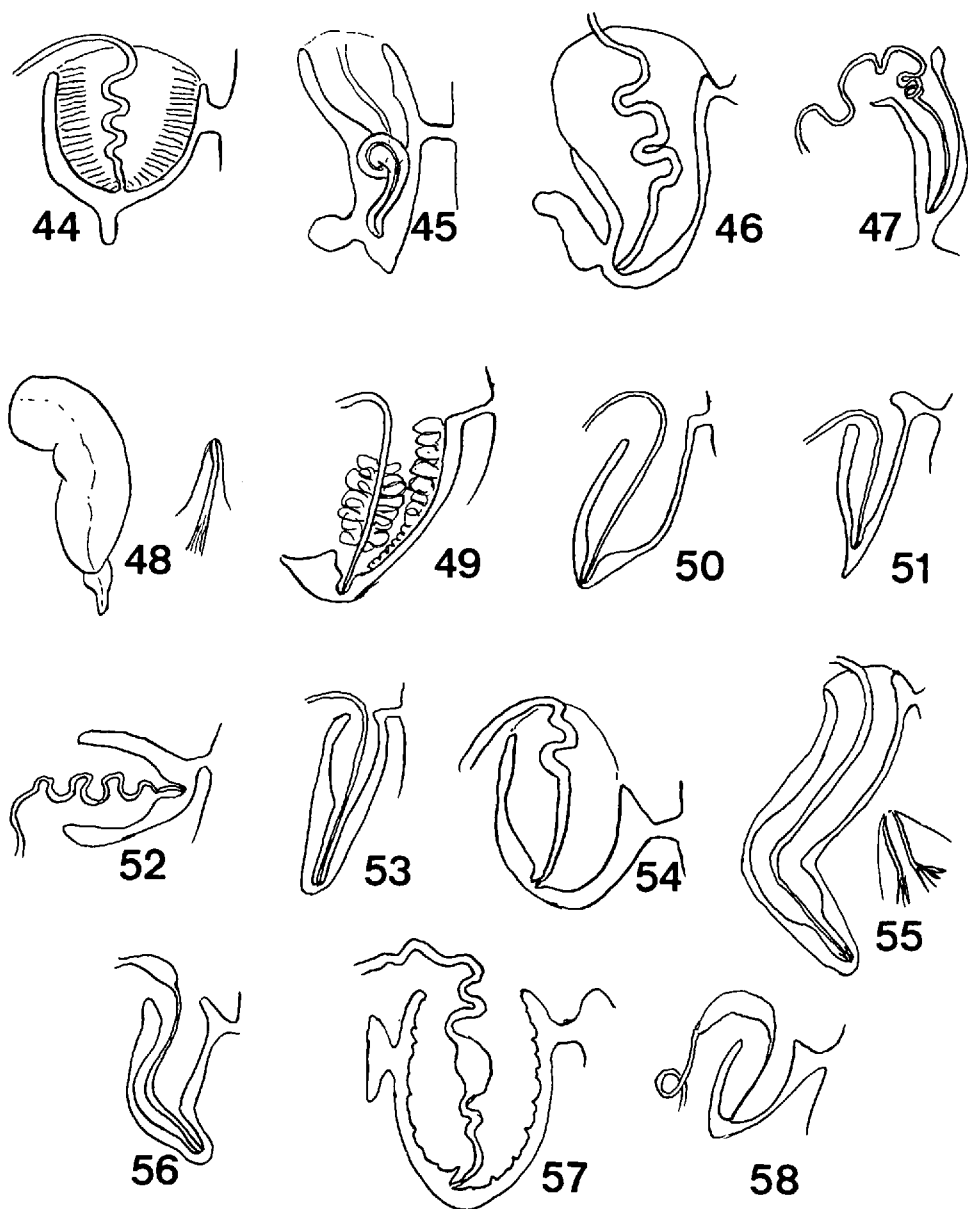
In the meantime I obtained one more specimen from Florida, a juvenile, without the paired gametolytic vesicles and without marginal papillae. Its dorsal vessels are like those in Brattström's animal.

NORTHERN AND EASTERN ATLANTIC SPECIES OF *ELYSIA*

Elysia viridis (Montague, 1804) from the eastern Atlantic, Baltic, and Mediterranean was figured several times with spread parapodia, so that the dorsal vessels are visible. Meyer and Möbius' (1865, pl. [1]) picture is compatible with Bergh's (1872: pl. 20, fig. 14) and with that in Thompson (1976: pl. 9a). Pelseneer's (1894, fig. 166) only showed the entrance of the vessels, because the parapodia are folded up. Hecht (1895: pl. 1, figs. 1a, 1b) gave two figures, a "normal" specimen of 1.2 cm length with very few vessels (Fig. 20), and one which had grown to 45 mm length in the aquarium (Fig. 19). The latter has still fewer, and less branched, vessels than Meyer and Möbius' 33 mm-long animal. Hecht's observation was recently confirmed and recorded in the Opisthobranch News Letter by K. B. Clark, Melbourne, Florida. He found that several species of opisthobranchs, so small that he had not noted them while he collected some algae, had grown to 7 cm in the course of 2 weeks when kept in large aquaria. A further sketch by Thomas Gascoigne, length not mentioned, is comparable with Hecht's "normal" slug from Roscoff. Though Hecht's experiment and other observations show that the size is no specific character, as little as the colors (Pruvot-Fol, 1953: 41; Ros, 1975: 306), I think it probable, that with exact study more species of *Elysia* will be found in the European Seas. Pruvot-Fol (1954: 201–202) distinguished three forms by their different colors. As most figures are drawn with closed parapodia, the simplest criterion, the dorsal vessels, are not recognizable (see Introduction). Bergh described the esophageal crop of *viridis* (1872: 182, pl. 20, fig. 17, d), which he called the stomach, and considered Allman's interpretation as erroneous.

A widening of the male duct at its entrance into the penis (Fig. 58) seems to be a good character (Bergh, 1872: pl. 20, fig. 25, pl. 21, fig. 12).

Meyer and Möbius (1865: 10) wondered, that "die heiteren Kinder des Mittelmeeres mit den ebenso wundervoll geschmückten des düsteren Nordens übereinstimmen."



Figures 44-58. Diagrams of the male copulatory organ of *Elysia*. 44, *E. ornata*. 45, *E. chlorotica*, coiled. 46, *E. chlorotica*, contracted. 47, *E. catulus*. 48, *E. papillosa*, evaginated, and stylet. 49, *E. canguzua*. 50, *E. serca*. 51, *E. chitwa*. 52, *E. cauze*. 53, *E. evelinae*. 54, *E. picta*. 55, *E. tuca*, evaginated, and stylet. 56, *E. clena*. 57, *E. patina* new species. 58, *E. viridis* (from L. Russell, 1929).

Elysia timida (Risso, 1818) from the Mediterranean is the type species of the genus. It was redescribed by Vayssi re (1888: 142, figs. 8, 119) from Marseille and by Swennen (1961: 59, figs. 11, 12) from Turkey. The small species is light green with red circular spots.

Elysia minuta (Sars, 1835) from Finmark to S. Norway is distinguished from the other species by blunt teeth (Bergh, 1881: 185, pl. 22, f. 25), the shape of which differs from that in *E. evelinae*.

Elysia fusca Philippi, 1844, from the Mediterranean was found, but not redescribed by Schmekel (1968: 110) in the Gulf of Naples.

Elysia halimeda Macnae (1954: 57, text fig. 2, pl. 3, fig. 2) from South Africa has subrectangular parapodia leaving a long, broadly rounded and rather flat tail free. The species called *halimeda* by Baba (1957: 70, pl. 3, fig. 1, pl. 4, figs. 1a, 1b) and Burn (1972: 177, fig. 10) has parapodia meeting on the tip of the pointed tail and papillae on the rhinophores. It is a different species which I rename *Elysia macnaei* new name, in honor of the late William Macnae.

The same odd shape of the parapodia of *halimeda* is also described for the unfigured *Elysia oerstedii* Mörch, 1860, from Costa Rica, and is figured for *Elysia latipes* Marcus (1960: 896, figs. 36–41) from the Maldives.

Elysia margaritae Fez (1962: 105, figs. 1, 2) from Valenciennes, Spain, has no specific characters in the description.

Elysia slimora Marcus (1966: 172, figs. 33, 34) from Annobon Island, West Africa, is papillose and characterized by very small teeth, 29 μm in the 4.5-mm long preserved slug.

Elysia translucens Pruvot-Fol (1957: 337) is not sufficiently described and was not accessible to me.

Elysia spec. Pruvot-Fol, 1954a: 27–29, fig. 10, from Oceania, might be recognized by its dorsal vessels, if ever found again.

Elysia fezi Vilella, (1968: 29–32, 2 figs.) from Barcelona, Spain, 4 specimens, has such remarkable teeth with a tricuspid base that it can easily be recognized.

Genus *Tridachia* Mörch, 1863

Tridachia crispata Mörch, 1863

Tridachia crispata Mörch, 1863: 40; Bergh, 1881, 191, pl. 9, figs. 4, 5, pl. 21, fig. 14, pl. 23, pl. 24, figs. 1–5; Marcus, 1960: 153, figs. 36–43; 1963: 23; 1967: 33, pl. 1, figs. 7, 8, text fig. 38; 1970: 50; d. B.-R. Marcus, 1976: 128.

Distribution.—From Honduras, Colombia, and Venezuela through the West Indies to Florida and Barbados.

Remarks.—The biggest animals were, preserved, 68 mm long. The synonymy of the species was discussed by Engel (1927: 115) and Marcus (1960: 158–159; 1962: 462; 1967: 33).

Genus *Bosellia* Trinchese 1891

As the species of *Bosellia* were treated in d. B.-R. Marcus (1972a; 1973), I do not repeat their descriptions and discussions here.

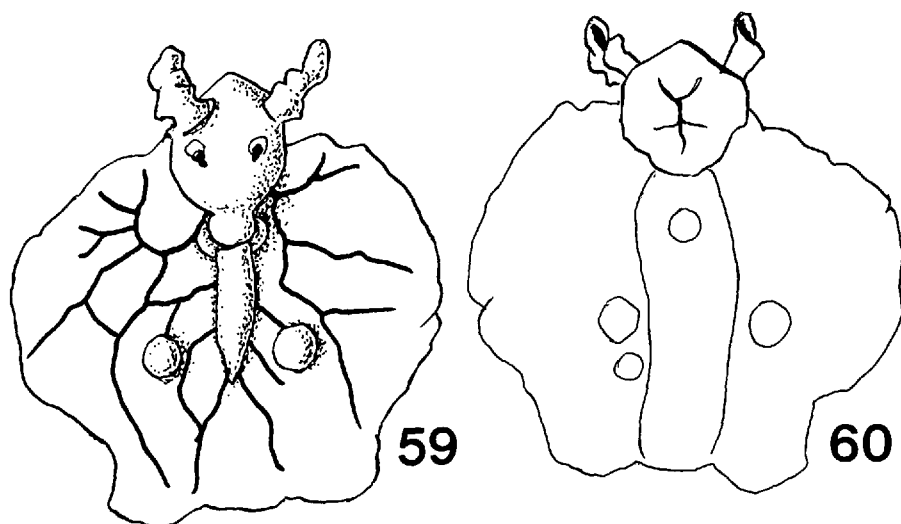
Bosellia mimetica Trinchese, 1891

Bosellia mimetica Trinchese, 1891: 773, figs. 1–12; d. B.-R. Marcus, 1980: 5, fig. 4.

Bosellia mimetica curasoe Marcus, 1970: 50, figs. 91–98; d. B.-R. Marcus, 1972: 811, figs. 2, 7, 10, 13.

Distribution.—Florida; Curaçao; Puerto Rico; Brazil; Mediterranean.

Remarks.—Specimens received from Luise Schmekel from the Mediterranean Banyuls, also have the curved stylet by which we distinguished the subspecies *curasoe* from *Bosellia mimetica mimetica*. Hence there is no separating character and the subspecies is not necessary.



Figures 59, 60. *Elysia patina* new species, from the Bahamas. 59, Dorsal view. 60, Ventral view.

Bosellia marcusi d. B.-R. Marcus, 1972

Bosellia marcusi d. B.-R. Marcus, 1972a: 293, figs. 19–22; 1973: 811, 819, figs. 1, 7, 11, 12, 15; Thompson, 1977: 132, fig. 29.

Distribution.—Florida; Jamaica.

Bosellia corinneae d. B.-R. Marcus, 1973

Bosellia corinneae d. B.-R. Marcus, 1973: 812, figs. 3, 9, 14.

Distribution.—Florida.

LITERATURE CITED

- Abe, T. (supervised by Kikutar Baba) 1964. Opisthobranchia of Toyama Bay and adjacent waters. Tokyo, Hokuryu-Kan, IX + 99 pp., 36 pls.
- Allan, J. 1947. Nudibranchia from the Clarence River Heads, North Coast, New South Wales. Rec. Aust. Mus. 21: 433–463, pls. 41–43, map.
- Baba, K. 1936. Opisthobranchia of the Ryukyu (Okinawa) Islands. J. Dep. Agric. Kyushu Imp. Univ. 5: 1–50, pls. 1–3.
- . 1949. Opisthobranchia of Sagami Bay collected by His Majesty the Emperor of Japan. 1–194 + 7 pp., 161 text figs., 50 pls. Iwanami Shoten, Tokyo.
- . 1955. Opisthobranchia of Sagami Bay, Suppl.: 1–59, pls. 1–20. Tokyo.
- . 1957. The species of the genus *Elysia* from Japan. Pub. Seto Mar. Biol. Lab. 6: 69–74, pls. 3, 4.
- . 1966. Gross anatomy of the specimens of the shelled Sacoglossan *Volvatella* (*Arthessa*). Pub. Seto Mar. Biol. Lab. 14: 197–205, pls. 7–10.
- Bailey, K., and J. S. Bleakney. 1967. First Canadian report of the Sacoglossan *Elysia chlorotica* Gould. Veliger. 9: 353–354.
- Bandel, K. 1976. Egg masses of 27 Caribbean opisthobranchs from Santa Marta, Colombia. Stud. Neotrop. Fauna. 11: 87–118, 11, 27 figs.
- Bergh, R. S. 1872. Malacologische Untersuchungen, 1 (Heft 3–4): 137–203, pls. 17–24.
- . 1881. Malacologische Untersuchungen. 4, Suppl. zu 2: 79–128, pls. G–L.
- . 1886. Beiträge zur Kenntniss der Aeolidiaden, VIII. Verh. Zool. Bot. Ges. Wien 35(1885): 1–60, pls. 1–7.

- . 1905. Die Opisthobranchiata der Siboga Expedition, part 50: 1–248, pls. 1–20. Leiden (E. Brill).
- Burn, R. 1972. A guide to the Ascoglossa or sap-sucking sea-slugs of Australia. Australian Natural History, March 1972: 173–175, 15 figs.
- Clark, K. B. 1975. Nudibranch life cycles in the Northwest Atlantic and their relationship to the ecology of fouling communities. Helgoländer wiss. Meeresunters. 27: 28–69.
- , M. Busacca, and A. Goetzfried. 1975. Developmental patterns in tropical Atlantic Nudibranchia and Ascoglossa and their relationship to trophic stability. American Zoologist. 15: 793 (Abstract).
- Eliot, C. N. E. 1908. Notes on a collection of nudibranchs from the Red Sea. J. Linn. Soc. Zool. 31: 86–122.
- Engel, H. 1927. Westindische Opisthobranchiate Mollusken, II. Bijdr. Dierk. Afl. 25: 83–122, figs. 1–38.
- Fez, S. de 1962. Dos nuevos ascoglossos y un *doto* en el puerto de Valencia. Bol. Soc. Españ. Hist. Nat. 40: 105–112, 6 figs.
- Franc, A. 1968. Gastéropodes opisthobranches. In Grassé, Traité de Zoologie. 5: 608–893, 2 pls.
- Franz, D. R. 1968. Occurrence and distribution of New Jersey Opisthobranchia. Nautilus. 82: 7–12.
- Gould, A. A. 1870. Report on the Invertebrata of Massachusetts, 2nd. ed., comprising the Mollusca. V + 524 pp., pls. 16–27. Boston.
- Hecht, É. 1895. Contribution à l'étude des nudibranches. Mém. Soc. Zool. France. 8: 539–711, pls. 1–5.
- Hosoe, K. 1956. Notas biológicas sobre *Elysia serca* Marcus, 1955. Contr. Avuls. Inst. Oceanogr. (Biol. 2): 1–7, pl. 1.
- Kay, E. A. 1964. A new species of *Berthelinia* and its associated sacoglossans in the Hawaiian Islands. Proc. Malac. Soc. London. 36: 191–197, pl. 9.
- Kelaart, E. F. 1858. Descriptions of new and little-known species of Ceylonese nudibranchiate mollusks. Ann. Mag. Nat. Hist. ser. 3, 3: 291–304, 488–496.
- Macnae, W. 1954. On four sacoglossan molluscs new to South Africa. Ann. Natal Mus. 13: 51–64, pl. 3.
- Marcus, Ernesto, or Eveline and Ernesto. 1955. Opisthobranchia from Brazil. Bolm. Fac. Fil. USP, Zool. 20: 89–262, pls. 1–30.
- . 1957. On Opisthobranchia from Brazil (2). J. Linn. Soc. Zool. 43: 390–486, 246 figs.
- . 1960. Opisthobranchia aus dem Roten Meer und von den Maldiven. Ak. Wissensch. Lit. Mainz, Jahrg. 1959. No. 12 (1960): 871–934, figs. 1–86.
- . 1960a. Opisthobranchs from American Atlantic Warm Waters. Bull. Mar. Sci. 10: 129–203, figs. 1–97.
- . 1962. Opisthobranchs from Florida and the Virgin Islands. Bull. Mar. Sci. 12: 450–488, 28 figs.
- . 1963. Opisthobranchs from the Lesser Antilles. Stud. Fauna Curaçao. 19 (79): 1–76, 68 figs.
- . 1966. Opisthobranchs from Tropical West Africa. Stud. Trop. Oceanogr. Miami. 4: 152–208, 62 figs.
- . 1967. American opisthobranch molluscs. Stud. Trop. Oceanogr. Miami. 6: VIII + 256 pp., 1 pl., 250 figs.
- . 1970. Opisthobranchs from Curaçao and faunistically related regions. Stud. Fauna Curaçao. 33: 1–129, 160 figs.
- Marcus, E. d. B.-R. 1970. On some opisthobranchs from Canania. Bolm. Zool., 27: 207–228, 4 pls.
- . 1972. Notes on some opisthobranch gastropods from the Chesapeake Bay. Chesapeake Science. 13: 300–317, 8 figs.
- . 1972a. On some opisthobranchs from Florida. Bull. Mar. Sci. 22: 284–307, 36 figs.
- . 1973. On the genus *Bosellia* (Mollusca, Gastropoda, Ascoglossa). Bull. Mar. Sci. 23: 811–823, 15 figs.
- . 1976. Marine euthyneuran gastropods from Brazil (3). Stud. Neotrop. Fauna. 11: 5–23, 14 figs.
- . 1976a. Opisthobranchia from Santa Marta, Colombia. Stud. Neotrop. Fauna. 11: 119–150, 33 figs.
- . 1977. An Annotated Checklist of the Western Atlantic warm water opisthobranch molluscs. Journ. Moll. Stud. Suppl. 4, 22 pp.
- . 1978. On a new species of *Bosellia*. Bolm Zool. USP, 3: 1–5, 5 figs.
- , and Helen Hughes. 1974. Opisthobranchs from Barbados. Bull. Mar. Sci. 24: 498–532, figs. 1–56.
- Meyer, H. A. and Möbius, K. A. 1865. Fauna der Kieler Bucht, I. Die Hinterkiemer oder Opisthobranchia. 126 p., 27 pls. Leipzig.

- Miller, M. C. 1961. Distribution and food of the nudibranchiate mollusca of the South of the Isle of Man. *J. Animal Ecol.* 30: 95-116.
- Mörch, O. A. L. 1860. Beiträge zur Molluskenfauna Central-Americas, Malako-zool. Blätter. 6.
- . 1863. Contributions à la faune malacologique des Antilles Danoises. *J. Conchyliol.* 11 (sér. 3, 3): 21-43.
- O'Donoghue, C. H. 1932. Notes on nudibranchiata from Southern India. *Proc. Malac. Soc. London.* 20: 146-166, fig. 1-8.
- Pease, W. H. 1860. Descriptions of new species of molluscs from the Sandwich Islands. *Proc. Zool. Soc.* 28: 18-36.
- . 1871. Descriptions of nudibranchiate mollusca inhabiting Polynesia. *Amer. J. Conchol.* 6: 299-305.
- Pelseneer, P. 1894. Recherches sur divers opisthobranches. *Mém. Cour. Acad. Roy. Belgique (Cl. Sci. Nat.)* 53: I-III, 1-157, pls. 1-25.
- Pfitzenmeyer, H. T. 1960. Notes on the nudibranch, *Elysia chlorotica*, from Chesapeake Bay, Maryland. *Chesapeake Science.* 1: 114-115, fig. 1.
- Pilsbry, H. A. 1893-95. Order Opisthobranchia. In Tryon, *Manual of Conchology.* 15: 134-436, pls. 18-61.
- Pruvot-Fol, A. 1946. Révision critique de la famille des Elysiadae. *J. Conchyliol.* 37: 29-44.
- . 1953. Études de quelques opisthobranches de la côte Atlantique du Maroc et du Sénégal. *Trav. Inst. Scient. Chérifien.* 5: 1-105, pl. 1-3. Tanger.
- . 1954. Mollusques Opisthobranches. In *Faune de France*, 58: 1-460, 173 figs., 1 pl. Paris (Paul Lechevalier).
- . 1954a. Etude d'une petite collection d'opisthobranches d'Océanie Française. *Journ. Conchyliol.* 94: 3-30, fig. 1-10.
- . 1957. Diagnose d'une Elysie peut-être nouvelle de la Méditerranée. *Bull. Mus. Hist. Nat. Paris.* Pp. 337-339, not seen, reviewed in *Vie et Milieu* 9: 254.
- . 1958. La radula des Ascoglosses. *Bull. Soc. Zool. France.* 83: 112-119, fig. 1-17.
- Reid, J. D. 1964. The reproduction of the sacoglossan opisthobranch *Elysia maoria*. *Proc. Zool. Soc. London.* 143: 365-393, 16 figs.
- Risbec, J. 1928. Contributions à l'étude des nudibranches Néo-Calédoniens. *Faune Colon. Françaises.* 2: 1-328, pls. A-D, 1-12.
- . 1953. Mollusques nudibranches de la Nouvelle Calédonie. *Faune Union Française.* 15: 189 pp., 126 figs. Paris.
- Ros i Aragones, J. 1975. Opisthobranquios (Gastropoda Euthyneura) del Litoral Iberico. *Investigación Pesquera.* 39: 269-372, 3 pls.
- Russell, H. D. 1946. Ecological notes concerning *Elysia chlorotica* Gould and *Stiliger fuscata* Gould. *Nautilus.* 59: 95-97.
- . 1964. New England nudibranch notes. *Nautilus.* 78: 37-42.
- Russell, L. 1929. The comparative morphology of the elysiid and aeolidioid types of the molluscan nervous system. *Proc. Zool. Soc. London.* 1929 (2): 197-233, pl. 1-10.
- Schmekel, L. 1968. Ascoglossa, Notaspidea und Nudibranchia im Litoral des Golfes von Neapel. *Rev. Suisse Zool.* 75: 103-155, 31 figs.
- Swainson, W. 1840. A treatise on malacology or shells and shell-fish. In D. Lardner, *The Cabinet Encyclopaedia.*
- Swennen, C. 1961. On a collection of Opisthobranchia from Turkey. *Zool. Meded.* 38: 41-75, 18 figs.
- Thiele, J. 1931. II. Subclassis Opisthobranchia. *Handb. systematischen Weichtierkunde* 1: 377-461, figs. 471-553; Nachtrag, 2 (1935): 1003-1004, 1096. Jena, Gustav Fischer.
- Thompson, T. E. 1973. Sacoglossan gastropod molluscs from eastern Australia. *Proc. Malac. Soc. London.* 40: 239-251, 3 figs.
- . 1976. Biology of opisthobranch molluscs, I: 1-206, 106 figs. Ray Society. No. 151.
- . 1977. Jamaican opisthobranch molluscs I. *J. Mollusc. Stud.* 43: 93-140, 32 figs., pls. 1-3.
- Trinchese, S. 1891. Descrizione del nuovo genere *Bosellia*. *Mem. R. Acad. Sci. Ist. Bologna. Ser. 5, 1:* 773-778, figs. 1-12.
- Vayssièrè, A. 1888. Recherches zoologiques et anatomiques sur les mollusques du Golfe de Marseille. Nudibranches et Ascoglosses. *Ann. Mus. Hist. Nat. Marseille. Zool.*, 3 (4): 1-160, pls. 1-7.
- . 1913. Mollusques de la France et des régions voisines. 1: 420 p., 42 pls. Bibliothèque de Zoologie (Loisel) Paris (Octave Doin).
- Verrill, A. E. 1873. Report upon the invertebrate animals of Vineyard Sound. *U.S. Fish. Comm. Exp.* 1871-1872, Pp. 295-778, pls. 1-38.

- . 1901. Additions to the fauna of the Bermudas. Trans. Connecticut Acad. 11: (1901-03) pt. 1 (2): 15-62, pl. 1-9.
- Vilella, M. 1968. Una nueva *Elysia* (Gastropoda Opisthobranchia) del Mediterráneo español, *Elysia fezi* n. sp. Miscel. Zool. 2: 29-32, 2 figs.
- Yonge, C. M., and H. M. Nicholas. 1940. Structure and function of the gut and symbiosis with zooxanthellae of *Tridachia crispata*. Pap. Tortugas Lab. 32: 287-301, 9 figs. Carnegie Inst. Washington, publ. 517.

DATE ACCEPTED: September 13, 1977.

ADDRESS: Caixa Postal 6994, 01000 São Paulo, Brasil.